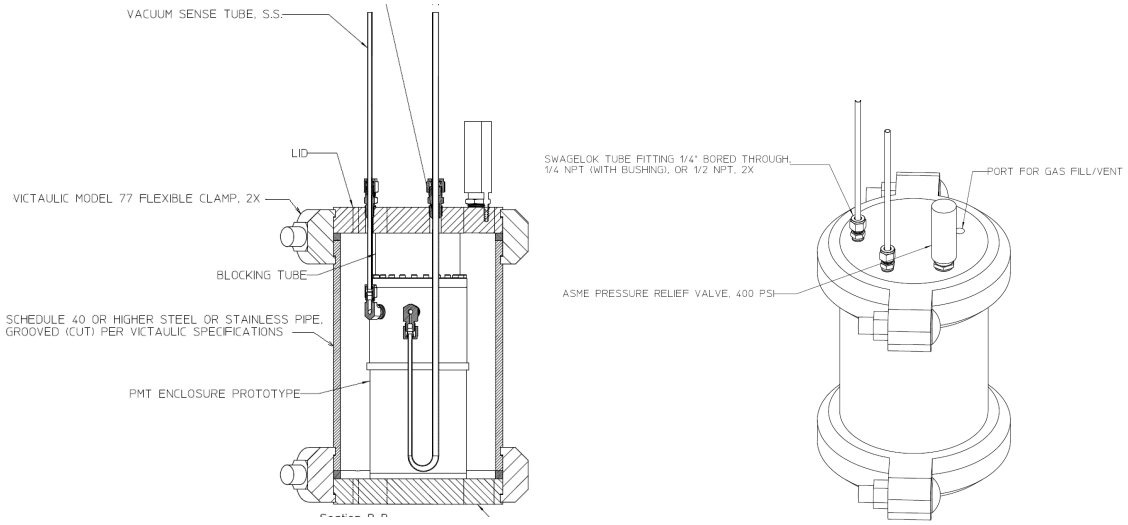
proj: **NEXT-100 XENON TPC**
Energy Plane, Tooling
title: **Pressure Safety Note, Pressure Test Chamber**

DRAFT

This is an Engineering Safety Note for a small pressure vessel to be used for gas pressure testing prototype photomultiplier tube (PMT) enclosures for the NEXT-100 Xenon Time Projection Chamber (TPC). The PMT enclosures operate under external xenon gas pressure of 15 bara.

The pressure vessel is a simple construction using Victaulic grooved pipe couplers with a section of 6" IPS schedule 40 pipe, 9 inch long, and two 1 inch thick caps. This results in a much lighter and easier assembling vessel than a similar one with ANSI flanges. One cap, the lid, is drilled and tapped for several 1/4NPT fitting to allow pressurization/vent, pressure relief and two service tubes from the PMT enclosure inside the vessel to be brought out.

The vessel will likely be used no more than 2 dozen times.



Background

NEXT is a collaboration between LBNL and other institutions to build a detector to observe neutrinoless double beta decay. The NEXT-100 TPC will contain 100 kg of enriched xenon gas at up to 15 bara pressure. The PMTs used inside this gas volume cannot withstand this pressure, so an enclosure has been designed to protect it.

Although not the subject of this Note, this PMT enclosure is designed in accordance with ASME PV code sec VIII div. 1, and sees external pressure only. It is fabricated from OFE (C10100) copper for high radiopurity, and is heavily built to provide shielding from background gamma rays. The enclosure incorporates a single crystal sapphire window for the PMT to view light produced in the xenon gas; this is the critical strength component of the enclosure due to its brittle failure mode. There will be a total of 60 of these windows inside the TPC, and they have been designed using the methodology of the Weibull distribution, in combination with linear elastic fracture mechanics to provide a quantitative estimate of reliability. These windows will be pressure tested hydrostatically in a separate test chamber (described in a separate note) before using.

This pressure test chamber is for the purpose of demonstrating proper PMT operation under high pressure conditions. We are primarily interested in measuring Xenon permeation